

## A SKETCH OF THE KEILOR PLAINS FLORA.

BY C. S. SUTTON, M.B., B.S.

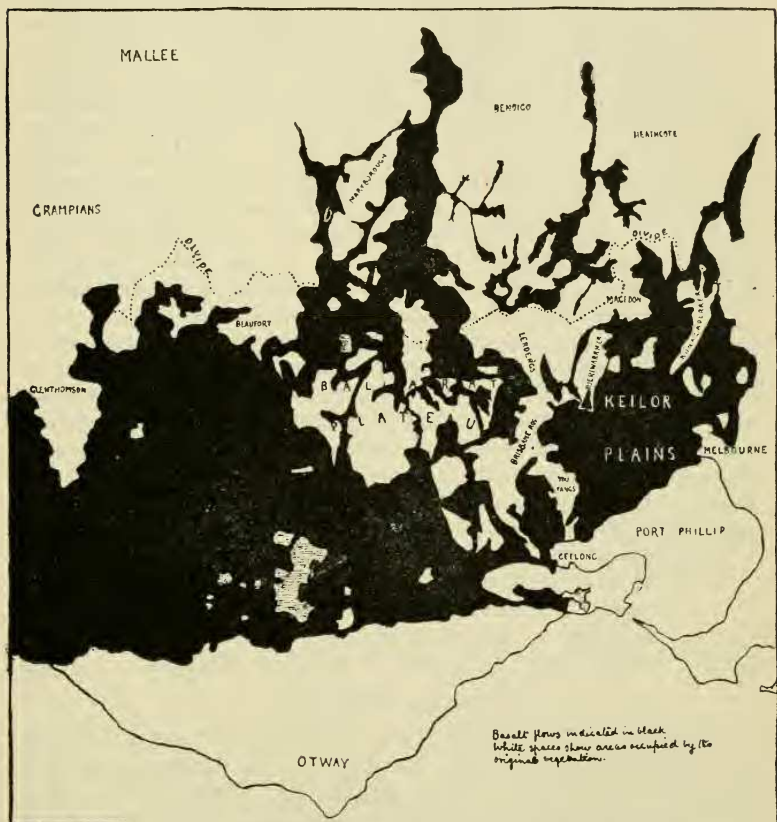
*(Read before the Field Naturalists' Club of Victoria, 11th Sept., 1916.)*

IN attempting to sketch in an ecologic way the vegetation of the environs of Melbourne, a commencement might perhaps have been made more fittingly with that of the basalt plains, seeing it is apparently the youngest of the three plant formations of the district. That the formation of the coastal sands, already described as the "Sandringham flora," was first dealt with was due, apart from its superior floristic attractiveness, mainly to the fact that a knowledge of its plants, because of the nearness and accessibility of the site, was more easily acquired. Also it was feared that this flora was in such imminent danger of destruction near by that very soon it would not be so conveniently available for study.

The flora of the basalt, however, has suffered even more than that of the "sands" from human interference. The area is not favoured for residential purposes, and has not been much built over; but it has been put so thoroughly to pastoral and agricultural uses that hardly any part now remains in the virgin state. Sufficient of the original flora, nevertheless, in spite of periodical burns, yet exists within the railway reserves, in the stony paddocks which have never yet been cultivated, and more particularly in the canyon-like water-courses and on their steep banks, that a very good idea can be formed of its original appearance and constitution.

In this paper the area considered lies roughly within a circle having a radius of about thirty miles from Melbourne, and measures nearly 900 square miles. The continuity of the basalt is here broken only by the granite near Broadmeadows, by a tongue of the Silurian to the west of Beveridge through which the main branch of the Saltwater River runs, and by Ordovician rocks to the north and west of Sunbury, the same rocks also overlapping the line discontinuously from near Bolinda to Parwan. In the deeper water-courses the bed-rock is also frequently exposed. On the western side the boundary is defined by the Djerriwarrh Creek. To the south-west, where the basalt is continuous with that of the Western District plains extending to the Glenelg River, the limit set just touches the eastern border of the granite of the You Yangs, and reaches the shores of Port Phillip somewhat north of Point Wilson. On the east the meeting with the Silurian is marked roughly in succession by the Moonee Ponds and Darebin Creeks and the Plenty River to near Yan Yean. Thence the line of contact runs north-west to the Merri Creek near Wallan, and then to the gap in the main divide at Pretty Sally's Hill known as

the Kilmore "geocol." This point, about 1,200 feet above sea-level and exactly on the 30-mile line, is of some interest in connection with plant distribution (see "Australia: Physiographic and Economic," by Griffiths Taylor, *Proc. Linn. Soc. of N.S.W.*, xxxi., p. 225). Excepting the extruding or un-



SKETCH MAP OF BASALT FLOWS WEST OF MELBOURNE.

submerged rocks above mentioned, and something more than a score of low hills, the surface, taken as a whole, is a plain. The hills lie mostly in the northern part of the area, mainly along the road from Digger's Rest to Gisborne, and almost all are considered to have been volcanic vents. Over broad spaces the surface, where it is not boulder-strewn, is quite flat, and gradually rises from the coast to a height of 464 feet at Parwan, and to just over 1,200 feet at Riddell and the geocol. In places

where the creek valleys are wide, or where some hills have weathered more than others, there are long, gentle slopes which give a little relief to the general monotony of the locality.

The water-courses draining the area are the Little River, Werribee River, Skeleton Water-holes, and Kororoit Creek, with independent outlets to the sea; and the Maribyrnong or Saltwater River, the Moonee Ponds, Merri, and Darebin Creeks, emptying into the Yarra. All of these, in the fewness of their tributaries, the steepness of their banks and hanging valleys, furnish evidence of youthfulness, and the system contrasts with the more mature state of that of the forest area on the east and with the very ill-defined system of the coastal sands.

The area under consideration is known as the Keilor or Werribee Plains, or the basalt plains, and, while for some reasons it might have been advisable to use the latter name in designation of its flora, for others which seem better the term "Keilor Plains flora" has been preferred.

The vegetation of these wide-spreading plains presents a picture contrasting strikingly with the dense scrub-heath to the south-east and with the forest formation lying between. Inasmuch as it consists mainly of grasses mixed with low herbs and shrubs, it is a grass-land formation, and, like the scrub-heath and forest in their relation to the coastal sands and the Silurian, it is found to conform closely to the basalt. It, in fact, constitutes a quite distinct type of vegetation, exemplifying a large part of the plant cover of the State.

Before dealing in some detail with this plant formation and its constituents, the principal conditions or factors which make up the "habitat" or environment, and of which the vegetation is the "reflex" or result, will be briefly considered.

#### *Climatic Conditions.*

Reference to the weather records shows that rainfall is lower over the basalt than on the "sands" or the Silurian, and that this is especially the case as regards the southern and larger part of the area, where the fall averages only a little more than 20 inches annually in about 100 days. We find, for instance, taking only stations where records have been kept for periods longer than five years, that the figures are:—Altona, 19.37 in 7 years; Werribee, 20.19 in 33 years; Little River, 20.01 in 25 years; Bacchus Marsh, 20.93 in 26 years; Melton, 20.90 in 21 years; and Keilor, 21.48 in 16 years. Doubtless there are drier localities than these, as, not far outside the 30 miles radius, Lara has 17.57 in 7 years, and Victoria Salines, near Geelong, only 17.09 in 10 years.

Over the northern portion, at more elevated stations, the

rainfall rises from 23.11 inches at Sunbury in 20 years, 24.97 inches at Yan Yean in 52 years, 26.70 inches at Mickleham in 5 years, 24.58 inches at Wallan in 16 years, to 29.25 inches at Beveridge in 5 years and 30.67 inches at Gisborne in 10 years. On the "sands" the average is about 29 inches, and on the Silurian about an inch more.

Although more rain falls in the spring and autumn, precipitations are pretty evenly distributed throughout the year. The bulk of the area, as well as the country about Geelong and the Bellarine Peninsula, is termed by meteorologists a "locally dry" or "shadow" area, and the comparative lowness of the rainfall is apparently due, apart from the low elevation, to the interception of the moisture in the south-westerly winds by the high ground of the Otway, and perhaps to a lesser degree the Divide has the same influence on those from the north. In spring and summer southerly winds prevail; in autumn and winter those from the north are most common and strongest. East winds are by far the lightest and least prevalent.

As regards air temperatures, records are available only for Laverton and Bacchus Marsh, and do not differ materially from those taken at Melbourne, Brighton, and Camberwell.

With the surface so sparsely covered and the so frequent occurrence of projecting boulders, the soil temperature must surely be higher than in the other areas. For the same reasons it is pretty safe to conclude that evaporation is greater. Radiation must be relatively high, and frosts are probably more frequent. Sunlight, too, has full play in producing the greatest effects.

#### *Soil Conditions.*

The soil is black or reddish, and formed *in situ* from the generally closely underlying rock. It is stiff and tenacious, with little humus, appears to have considerable water-holding capacity, and the proportion "available" for support of plant life is less than that in the "sands," at least. Though the slope is so gradual, water does not anywhere lie long into the summer, no doubt quickly percolating through the vertically fissuring rock beneath; and in midsummer, under the unmitigated influences of sun and wind, the surface cakes to an extreme degree and cracks freely.

The influence of animal life has probably always been present, and it may be safely assumed that these plains have in the past been the favourite grazing grounds of such indigenous game as kangaroo, wallaby, and emu.

The configuration of the surface and the absence of cover exposing it to the influence of wind and the sun's light and heat in the fullest degree, the comparatively scanty rainfall, the shallow, dark, boulder-containing, heat-absorbing soil, and



the continual grazing of animals have each in varying degrees been responsible for the low, sparse plant cover we see to-day. The grass-land is, then, the "reflex" of the sum total of these comparatively severe conditions which constitute the "habitat."

While the conditions are by no means so extreme as those responsible for certain grass-lands in other parts of the world known as grass-steppes, the principal examples of which are the steppes of Russia, the prairies of North America, and the veldt of South Africa, they have yet been sufficiently pronounced to have impressed on the vegetation of the basalt plains many of the features of grass-steppes. Thus, the short plant cover of dominant grasses, with herbs and stunted undershrubs, is mainly xerophytic; it does not form a close carpet as in a meadow, the bare ground being constantly visible, and it fades in summer. Many of its grasses are tufted and have rolled leaves, and composites (16 per cent.) and annuals (12 per cent.) form large proportions of its constituent species. While bulbous and tuberous plants and perennials with deep tap-roots or thick root-stocks are present, they are, however, not prominent. Thus the formation, if it may not be called a grass-steppe, is at least a grass-land with steppe-like characters, though Diels would possibly regard it as dry pasture or "trift" in his classification.

Further, it is agreed that all undisturbed land surfaces are destined, sooner or later, to pass, either indirectly by way of scrub-land or directly, into forest. It is also laid down that a rainfall of at least 20 inches in about 100 days is required to favour forest growth. Although over wide stretches of the basalt plains trees are absent, and from all appearances, or want of them, have never existed, it is quite obvious that the change from grass-land to forest has been steadily but very slowly taking place. In the southern portion, where the necessary condition as regards rainfall just exists, this change is not at once visible, though individual trees and groups of them are to be found widely scattered. It is in the northern part of the area, with a higher rainfall, that the change is more obvious, partly in the advance of trees up the branches of the main water-courses and over the edges of the latter on to the plain, but principally at the outskirts, by the invasion of trees from the neighbouring forest formations.

The surface of the basalt is comparatively new—it is assumed that it is newer than those adjoining—but probably not so new that it would not at the present time have supported forest if conditions had been more favourable. The transition, so far as it has gone, appears to have been direct. Adverse conditions have delayed it, and it may be concluded that ultimately, if

natural conditions had continued, the whole area would have maintained a growth of trees in the shape of open forest, the reasons for the present cover being partly climatic, partly edaphic, and partly secular.

### *The Grass-Steppe.*

It will help, in describing the flora of the grass-land, to contrast with it that of the coastal sands, with which we are all so familiar. In the first place, while this latter presents only two seasonal "aspects"—the blossoming time of spring and early summer (spring aspect) and the dull sage-green of the rest of the year (autumn aspect)—the plains exhibit three phases. Only in autumn and early winter is the general greenness of the dominant grasses almost unrelieved by blossoming plants (autumn aspect). Long before the winter is past many species are in flower, and by September the ground is golden with numerous composites, which play by far the greatest part in forming the spring aspect. Later, when the hot sun has burnt the grasses to a uniform brownness, many of this great order, with a sprinkling of other plants, long continue to brighten the uniform drab of the summer aspect. The fires of spring, as we know indeed, never quite die down, but always some ever-bloomer like *Convolvulus erubescens* or *Wahlenbergia*, some belated or precocious plants, keep their flags bravely flying, and link one flowering season with the next.

Although some hundred or more species are common to each formation, it is soon evident, on the most cursory survey, that none of those most characteristic of the Sandringham flora\* are to be found on the basalt; *Leptospermums*, *Hibbertias*, *Epacrids*, *Ricinocarpus*, *Amperea*, *Isopogon*, *Aotus*, *Casuarina distyla*, *Bossia cinerea*, all are absent. *Correa speciosa* certainly does occur, but in such different form, with shining, glabrous leaves and more spreading habit, that it is at first almost unrecognizable, and it, moreover, affects rocky places just below the brow of the river-banks.

Of grasses, one is surprised to find in a grass-land some lack of variety, nearly half of those listed being more or less strictly confined to the coast. *Danthonia penicillata* is most prevalent over the driest stretches, and often is unmixed with others; but now and then *Anthistiria* is most noticeable. The tussocky *Poa caespitosa*, *Stipa setacea*, *S. semibarbata*, and *Dichelachne crinita* seem to prefer moister places, and especially is this so with the *Panic* grasses. The others are less common or more restricted in range.

Composites constitute more than 16 per cent. of the total

\* "Notes on the Sandringham Flora," vol. xxviii., p. 5; vol. xxix., p. 79.

plants of the area (as compared with 9 per cent. at Sandringham), and form a still greater proportion of the strictly grass-land plants. The most prominent species are the *Podolepis*, *Leptorrhynchos*, *Craspedias*, *Vittadinia*, *Minuria*, *Heli-chrysums*, *Brachycomes*, and *Calocephalus*.

Apart from those occupying the foreshore, the *Chenopodiaceæ* make a better showing here.

Excepting the *eucalypts*, the *Myrtaceæ* are quite unrepresented; the *Proteaceæ* are also absent, and *Leguminosæ* play a very insignificant part. The most frequent member of the last order is the secretive *Bossiaea prostrata*. *Eutaxia empetri-folia*, flattening itself out into a mat form, is fairly often seen, but *Lotus australis*, the *Psoraleas*, the *Glycines*, and the rest are rather uncommon.

*Epacrids* are practically non-existent, only *Astroloma humi-fusa* (at Bulla) and *Lissanthe strigosa* being recorded in Mr. St. John's notes.

Orchids are a somewhat rare feature of the flora. Only *Diuris punctata*, var. *alba*, in the North-Eastern railway reserve, is at all frequent. The others are all sparingly distributed, the *Microtis*, *Diuris pedunculata*, and *Thelymitra longifolia* perhaps less so than the others.

The lilies are fairly well represented, principally by the *Arthropodiums* and *Dianellas*, *Burchardia* and *Wurmbea*.

Two ferns manage to exist in the open country. Strangely enough, one of these is *Cheilanthes tenuifolia*, amongst the most delicate and fragile of all, and the other the diminutive little Adder's Tongue, *Ophioglossum vulgatum*. Both occur frequently and widely, the latter seeming to have been unusually abundant this past season.

As one would expect, the *Cyperaceæ* and their allies, save in the rare wet places and in the trenches in railway reserves, are almost confined to the creeks and the coast.

Apart from grasses and composites, the plants most typical of the grass-land belong to many less important orders. *Velleya paradoxa*, now only found on the clay cliffs just south of Brighton Beach, is here abundant, with its close relation, *Goodenia pinnatifida*. Five *Pimeleas* can be collected, all but one being quite common. *P. serpillifolia* and *P. curviflora*, with a very similar growth form, do not exceed a few inches in height, though the latter in the shelter of the forest attains almost as many feet, and bears flowers of a lighter shade. *Stackhousia linarifolia*, also in stunted form, is constantly seen; so is *Asperula scoparia* and the *Trichiniums*, especially *T. spathulatum*; and these last, in their thickened root-stocks, present a feature commonly possessed by plants growing in dry places. Generally when the grass is dried up does the

very beautiful wedgewood-blue of the *Eryngium rostratum* most compellingly take the eye, and with it are very often associated *Convolvulus erubescens*, *Erythræa*, *Wahlenbergia*, and the *Calocephalus*.

Many other plants are individually even more numerous than the above-mentioned, but their insignificance or nondescript appearance or colour prevent easy recognition. Some of these, subordinate in spite of numbers, are *Helipterum dimorpholepis*, *Lobelia concolor*, *Sebæas*, *Tilleas*, *Hydrocotyles*, *Læwenhoeckia*, *Oxalis*, *Veronica gracilis*, *Erodium*, and *Stuartina Muelleri*. Except those species occupying the infrequent patches of damp ground, definite plant associations are not easily recognizable on the plains. The changes in the composition of the vegetation are gradual and subtle, and the whole area may be considered, with the above qualification, as one large "association." Where water lies longest plants commonly found elsewhere in similar situations, such as *Isotoma fluviatilis*, *Lythrum hyssopifolia*, *Selliera radicans*, *Epilobium*, *Lobelia anceps*, *Cotulas*, and others, are also noticed here. *Damasonium* and *Alisma* may not uncommonly be discovered in company, and *Marsilea* is occasionally met with. At the outskirts of the plains, where members of the neighbouring formations are pushing in, in the shelter of the canyons, and especially towards the coast, where the varying moisture and salinity of the ground determine the grouping, quite well-marked associations are noticeable.

### *Tree Growth.*

Before dealing with these groups, reference may be made here to the tree growth of the area. Although ten eucalypts have been noted, only four exist in such numbers that they may be said to belong to the basalt. Of these, the River Red Gum, *E. rostrata*, is undoubtedly predominant, exceeding the others in numbers, distribution, and range. In the eastern part, especially about and between Epping and Woodstock, it forms fine open forests, where trees quite often attain imposing proportions. Perhaps no other of the great genus shows so much individuality as this species, no two trees being quite alike except in that they all bow more or less to the pole in deference to the will of the strong north winds. The varied sweep of their massive, far-outreaching, and often strangely contorted branches, and the sober yet rich colouring of bole and limbs, endows them with a picturesqueness quite redeeming the flat country from its monotony. The Red Gum has almost undisputed possession of all the water-courses, often extending in that way right up on to the open plain. Isolated groups exist near Point Cook and on the Werribee Sewage Farm, and the trees, though small, appear to be of considerable age.



Associated with the Red Gum on the plains more often than the others is the Swamp Gum, *E. ovata*, which, in the moister places, frequently exists in little communities. Its shining, coarse foliage and generally scraggy appearance make it easily distinguishable. It rarely attains any great size, and its so often decrepid condition suggests decadence and the likeliness of its ultimate disappearance from this locality. One of the best of the few good examples of this tree occurs near Dixon's Lane, close to the Darebin Creek. The most extensive 'area dominated by the species lies between Darraweit Guim and Bolinda, where, with *Casuarina quadrivalvis* and *Poa caespitosa*, it composes a well-marked association.

The Grey Box, *E. hemiphloia*, which is not found on the sands or Silurian, is next in importance to the Red Gum, and is somewhat exclusive. It is more sparingly distributed over the eastern parts, but on the other side, near Melton and Bulla and on the western slope of Gellibrand Hill, where some very fine trees can be seen, it forms open, pure forests of limited extent.

The Yellow Box, *E. melliodora*, is pretty common on the granite near Broadmeadows, and elsewhere is widely scattered in small groves, while a somewhat extensive forest of rather poor trees occurs to the east of Sunbury.

The Manna Gum, *E. viminalis*, and a very few specimens of the Yellow Gum, *E. leucoxylon*, intermingle with the others mentioned on the granite about Gellibrand Hill. The former is fairly common on the northern side, and has the appearance of the Sandringham rather than the riverside form. Both trees are not infrequent in certain places in the canyons, the Manna Gum standing on the terraces not far from the water, and the other climbing well up on the steep, rocky banks. Probably neither grows actually on the basalt, and certainly they have not been noticed on the plains.

A few Narrow-leaved Peppermints, *E. amygdalina*, are also in the canyons, and rare specimens of the Red Box, *E. polyanthemos*, and the Red Stringybark, *E. macrorrhyncha*, have intruded from the east, just as the Bull Mallee, *E. Behriana*, crosses the Djerriwarrh Creek from the west. In certain localities, as soon as the basalt is left, as in traversing the base of the tongue of Silurian projecting from the north, additional species, such as the Broad-leaved Peppermint, *E. dives*, Messmate, *E. obliqua*, the Long-leaf Box, *E. elæophora*, and the Candle-bark Gum, *E. rubida*, commence to make their appearance. These might be included in the list with almost as much reason as *E. leucoxylon* and others, and, strictly speaking, only the Red and the Swamp Gum and the Grey and the Yellow Box have really established themselves and naturally flourish on the basalt.

The *Casuarinas* were undoubtedly more numerous in the past, but, making good firewood, they have been freely cut down, and now are mostly seen about the low hills, occasionally in the gorges, and sparsely scattered over the plains. *C. quadrivalvis* is commoner than *C. suberosa*, and *C. Luehmannii* is confined to the western part of the area.

Of the tree-forms of *Acacia*, *A. pycnantha* is on the granite at Greenvale, *A. melanoxyton* and *A. implexa* in the same locality and also in the canyons. The latter is much the more frequent, and usually occurs on the steep, rocky banks. *A. dealbata* is not uncommon on some of the streams, and, strangely enough, affects a rather dry situation on many of the basalt "blows."

*Exocarpus cupressiformis* is a constituent of the forest invading the plains from the east and occasionally seeks the shelter of the river-banks. An isolated specimen of *Bursaria spinosa* has reached tree size, with a trunk diameter of nearly 18 inches, near Point Cook, and one of *Myoporum insulare* of about the same dimensions near Digger's Rest.

#### *Plants of the Canyons and Water-courses.*

As a consequence of shelter from sun and wind afforded by the steep banks, greater moisture and more varied substratum, the vegetation on the rivers and creeks is much more luxuriant and diversified. Trees and shrubs are numerous, and frequently dense patches of scrub clothe the banks. The Red Gum quite dominates the situation, never being out of sight. In many dry creeks it is the only plant taller than the grasses and low herbs, and no other tree disputes its right to the water's edge. On the terraces, and climbing the banks, are occasional eucalypts of other species, and trees of lesser growth, like *Casuarina stricta*, *Acacia melanoxyton*, *A. implexa*, and *Exocarpus cupressiformis*. Where water is permanent *Leptospermum lanigerum* and *Callistemon salignus* often grow together below the bank. The most assertive of the shrubs is undoubtedly *Hymenanthera Banksii*. It is never or rarely absent from any association, and frequently possesses long stretches of the waterside with an attendant growth now of *Nicotiana suaveolens* and *Dichondra repens*, and again merely of *Urtica incisa*. It climbs the steepest banks, and, although a lover of moisture, will venture some distance on the plains.

South of Keilor, on the right bank, it is absent, and here we have *Dodonaea*, *Myoporum deserti*, *Cassia* (up to 7 feet high), *Acacia retinodes*, and *Muehlenbeckia Cunninghamii* (among rocks), the first perhaps predominating. Only occasionally *Acacia implexa*, *A. dealbata*, *Bursaria*, and *Correa* crop up in

this company, and a rather luxuriant carpet, especially about the roots of the shrubs, is made up of *Enchylæna*, *Rhagodia nutans*, *Calandrinia calyptrata*, and *Euphorbia Drummondii*. In another rocky situation we have *Myoporum viscosum*, *M. deserti*, *Dodonæa*, *Bursaria*, *Acacia acinacea*, *Hymenanthera*, *Zygophyllum*, and *Nicotiana*; and on some muddy flats *Muehlenbeckia Cunninghamii* occupies the ground exclusively.

In addition to the plants already mentioned, *Clematis microphylla* (obviously preferring rocky places and making its tangle on any handy shrub), *Goodenia ovata*, *Sambucus*, *Myrsine*, and *Rhagodia Gaudichaudiana* are not uncommon.

Water plants are remarkable for their wide geographical distribution, so easily effected by the agency of birds, and in the canyons and water-courses of the basalt representatives of most kinds can be studied. In still water or in the stagnant pools of smaller creeks examples of the free-floating aquatic plants (*Pleuston*) are seen in *Lemna*, *Wolffia*, and *Azolla*. The fixed forms (*Benthos*), rooted in loose soil or gravel under fresh water (*Limnæa-formation*), are not far to seek. Some of these may be completely submerged, like *Ranunculus aquatilis* and *Vallisneria spiralis*; but the majority have floating leaves, and mostly blossom above the surface, as in the *Potamogetons*, *Triglochin procera*, *T. striata*, *Ottelia ovalifolia*, *Myriophyllums*, *Callitriche*, and often the *Limnanthemums*.

A still larger group are the marsh plants (*helophytes*), mostly amphibious, and capable, by their plasticity, of adapting themselves to very wet or to comparatively dry situations. They occupy the shallows at the edges of the water, having only a portion of their stems submerged, or are rooted in mud. *Arundo*, *Typha*, *Scirpus lacustris*, *Heleocharis*, some of the *Polygonums*, *Lythrum salicaria*, and *Alternanthera nodiflora* are among those which may be placed in one category, while the *Gratiolas*, *Mimulus repens*, *Utricularia dichotoma*, *Tillæa recurva*, *Ranunculus rivularis*, *Limosella aquatica*, *Cotula coronopifolia*, *Alisma*, *Damasonium*, *Epilobium*, *Isotoma*, and *Scirpus inundatus* can be referred to the other. Towards the mouths of the streams, or in salt swamps, *Ruppia maritima*, *Potamogeton pectinatus*, and *Lepilæna Preissii*, which would be placed in Warming's *Enhaliid-formation*, have been noted submerged in the brackish water.

In the canyons ferns are only comparatively frequent. The *Adiantum*, *Asplenium*, and *Grammitis* are most easily found, the others being decidedly rare. Seeing its indifference to conditions, growing as it does in extremely dry and quite moist situation, one wonders why the latter is so impossible of cultivation.

*Coastal Plant Associations.*

Although in certain places the plain, with its own proper vegetation, ends abruptly at the sea in low cliffs, there is no belt of scrub clothing its edge as on the other side of the Bay. Mostly the western shores are very low-lying, and extensive areas are more or less affected by salt water. Salt plants, or halophytes, are consequently much more prominent, and the different conditions as regards moisture and salinity of the soil have led to very well defined associations. The first contains marine plants referred by Warming to "*Enhalid-formations*" among water plants (*hydrophytes*). Two of these—*Halophila ovata*, with delicate, transparent, elliptical leaves, and the more robust *Cymodocea zosterifolia*—are constantly submerged, and their existence in adjacent submarine meadows is inferred from the presence of their fragments in the wrack thrown up by the waves. Forming a considerable portion of this tangled mass of algae are the ribbon-like leaves of the third member of this group, *Zostera nana*, which thickly occupies sand-banks exposed at low water, and termed a "*zosteretum*."

The next association, that of the sand-loving salt plants, "*psammophilous halophytes*," inhabits the strand and the occasional small dunes lying just behind. *Cakile maritima*, *Salsola kali*, and *Atriplex cinereum* are most typical of the former station. *Tetragonia expansa* and *Apium prostratum* are also common, but *Calocephalus Brownii* is only occasionally seen. A little away from the water, on the dunes, are mostly grasses and sedges. *Zoysia pungens* and *Distichlis maritima*, forming dense mats, and *Spinifex hirsutus* have a creeping habit; *Festuca littoralis* and *Stipa teretifolia* are tufted. *Glycine stricta*, the Lepturus, the introduced *Elymus arenarius*, with *Scirpus nodosus* and *Carex pumila*, are the other principal species. Dicotyledons are rare. *Statice australis* and *Scævola suaveolens* have been noted, but only *Spergularia rubra* and a number of aliens are in any way abundant.

(*To be continued.*)

"OUR WATTLES."—This is the title of an illustrated booklet of 76 pages by Mr. T. C. Wollaston, of Adelaide, in which he describes in chatty way the charms of many of our wattles. The publication is illustrated by ten plates in colour of various species, but, unfortunately, they do not do justice to the species depicted. The difficulties in the way of producing a true colour-print of a wattle are very great—the yellows seem to be hard to get; but perhaps it is the natural fluffiness of a wattle bloom which renders it so difficult to reproduce. The fact of having been printed in England, far from the natural examples, has perhaps militated against the success of the illustrations.